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Modelling Software As a Service for Greenhouse Automation System with Internet Of Things

Yogiswara ST.MT, Husin.S.Kom M.MT
yogis@polije.ac.id.

Abstract. Greenhouse is a building that serves to protect plants from adverse climatic conditions for plant growth. Now, many greenhouses are developed with automation systems to control climate and regulate fertigation systems. Internet of Things (IoT) technology has also been implemented to support the greenhouse automation system so that control and observation of greenhouse automation instruments can be accessed via the internet. SaaS technology (Software as a service) is a cloud product designed to serve the needs of online applications so that greenhouse owners can use applications easily without developing applications independently. This research was conducted to develop a greenhouse automation model with SaaS-based applications. starting from survey and needs analysis, system modeling using service-oriented architecture (SOA) method and implemented using the Node-Red application. The testing method is carried out by measuring service speed in automation system applications in two types of services. telemetry data sensor services and instructions for running an actuator. The results of this study indicate that automation systems with saas platforms can functionally function like local automation systems. Internet connection latency time is one variable that affects the speed of data services.

1. Introduction

Greenhouse is a building that functions to manage environmental conditions in order to create desired conditions in the maintenance of plants. The shape of a greenhouse building is a building with frame and is formed like bubble, covered with transparent material or translucent that it can transmit light optimally and protect plants from adverse climate conditions for plant growth. Now the part of greenhouse is increasingly needed in order to increase agricultural production. Automation technology applied to greenhouse already implemented in many type, with local control technology[1], using logic control devices [2] and using Internet of Things technology [3]. Internet of Things Technology in the Agriculture Industry has implemented [6]. Now, the internet of things itself has become an industry, various microcontroller devices that were previously used locally are now equipped with internet connection facilities, various sensors have also been facilitated by drivers that can be easily synchronized with the microcontroller. Embedded system devices specifically designed to acquire sensor data and send to the internet can be done more simply but to develop a software application requires special expertise in programming. Saas (Software As A Service) is a cloud-based software developed to facilitate users to be able to utilize these applications as needed. Commercially Saas-based applications have economic efficiency seen from the aspects of benefits and usability in a business process. In this study we will developed a greenhouse automation application model that was built using the SaaS method with the aim that users can utilize the facilities needed to create an automation system in their greenhouse.

2. Automation needs of greenhouse systems

The general model of automation in greenhouses can be divided into two things, first is the management of the air environment by monitoring air humidity, temperature, light intensity and carbon dioxide. The parameter automation is measured through sensors installed in the greenhouse. The control process is

carried out by setting the set point by the plant expert, the set point as the basis of the control process where the output of the set point rules becomes the basis for activating various devices such as relays, motors and other actuators to produce wind, fog or cover greenhouse roof. the second is related to the process of fertigation related to the management of intake in plants. a fertigation system is a process of giving various vitamin elements needed by plants based on various parameters and given through the fertigation process [6] [7]. the basic picture of the greenhouse automation system in general can be seen in Figure 1.

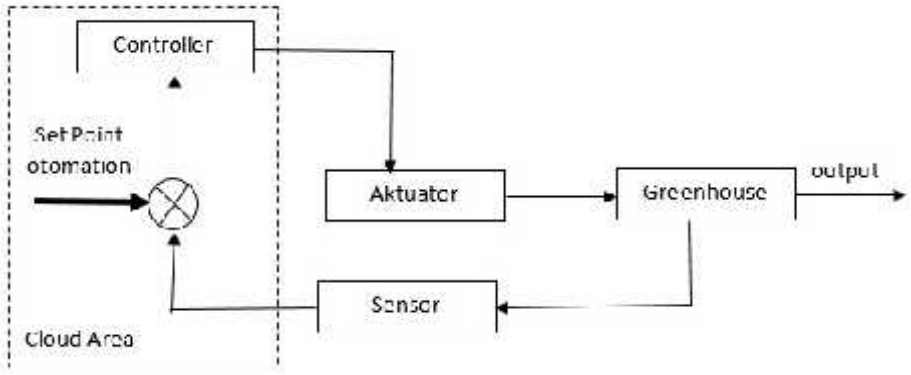

Figure 1. Block diagram generic greenhouse otomation system

3. Modelling design SaaS Application

3.1. Architecture Application Model

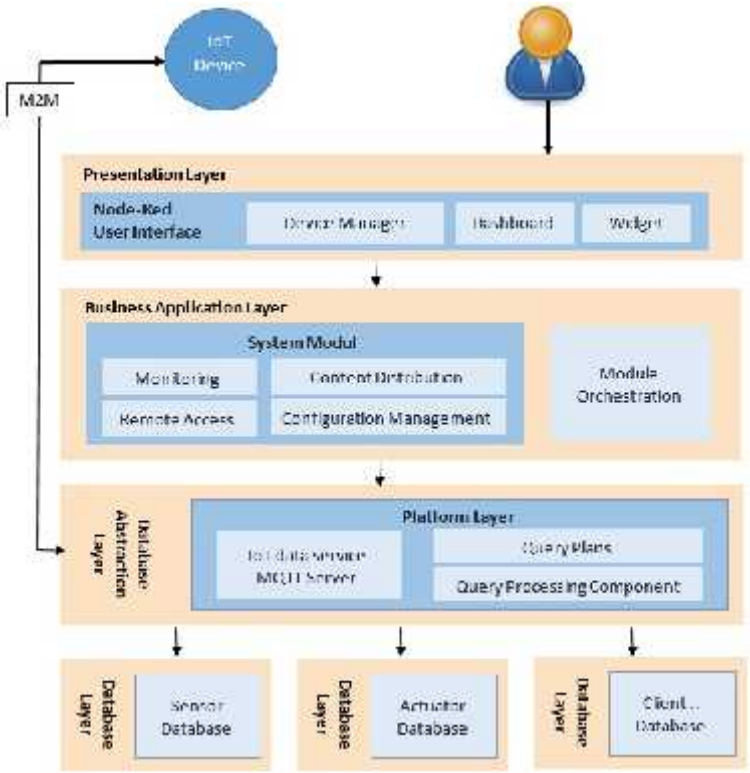

Figure 2. Architecture application design

The application architecture of Software As a Service for greenhouses is developed to meet the various features that are needed. In general, the application configuration consists of several parts, namely the database layer is a data storage section consisting of three types of databases. Sensor and actuator database are storage media for telemetry data that have different characteristics from the client database. In this implementation, telemetry databases are stored more in nosql-based data machines and client databases can use mysql-based or nosql-based machines. The abstraction layer is a layer of data processing functions such as insert, update and delete and select data. In this layer, model design is built to adjust the needs of the module system which is the layer above it. The layer of business application is the key to the development of a greenhouse automation system because in this layer generate modular system to developed automation model can be used by the user. Implementation in this layer using Node-Red application which is one of the SaaS-based applications. The top layer in this application architecture is the presentation layer where users will have a view to see the results of data transactions both telemetry data and actuator interface data. Implementation on this layer uses Front End for Node-Red or known as FRED.

3.2. Businnes process generic greenhouse model

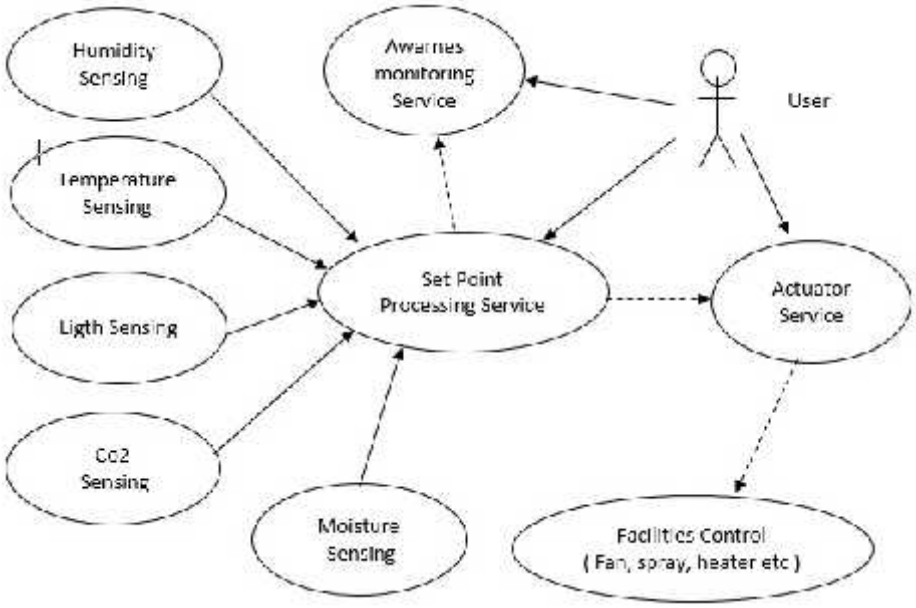

Figure 3. use case diagram generic greenhouse system

In general, the process business in the greenhouse starts from management a variety of sensor data as a input device. The input data is the basis for the development of automation which is simply described in the set point process. Based from this set point process made a trigger to activated actuator device ti druver many type of mechanical device. And also activated warning information is executed so that this all process can made effisien for the greenhouse user.
Implementation in the business process layer is developed through the Node-Red application. In addition to these applications, other supporting applications are needed, like databases and mqtt servers. Model development for remote access and module monitoring is done through a web-based application. Here is an example of a remote access module for a lamp and light sensor monitoring can view in figure 4

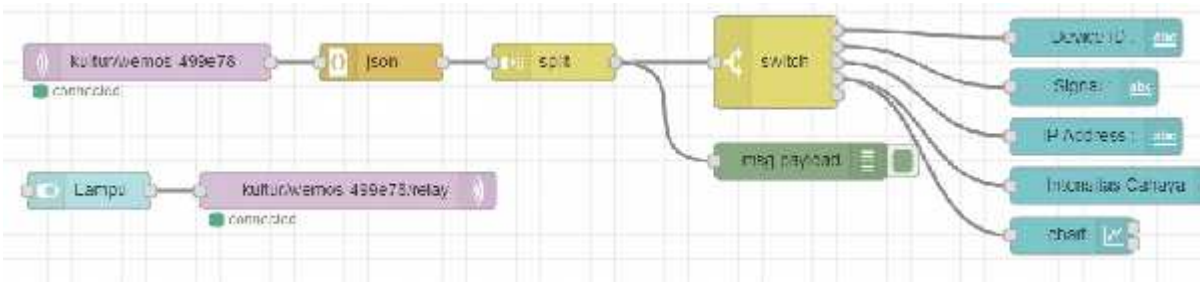

Figure 4. Actuator and sensor module businnes application layer

After the system module design is complete, users can compile directly and the results can be used immediately. The compilation results are the presentation layer which is the user interface display. The following is the compilation of the modules developed in Figure 5 which are displayed in a widget.

Figure 5. actuator and sensor user interface in presentation layer

4. Conclusion

Node-red application is very effective for developing service-based applications.
the business process layer becomes the most important part to facilitate the creation of modules as needed, and by using node-red a series of business processes consisting of several modules can be packaged into one module.
technically the design of sensor and actuator devices must be equipped with data communication specifications related to the mqtt protocol

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